

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 16

*23 However, Kodak's 1979 introduction of the Colorburst 250, equipped with a built-in electronic flash, did expand demand in one particular market--Saudi Arabia. There, privacy is of great concern. Instant photography which does not require the public act of developing is desirable. More importantly, religious customs prohibit photographing women outside the home. Therefore, an instant camera without a flash is of little use. When Kodak introduced the Colorburst model with a flash, the Middle Eastern market exploded. Sales grew from approximately 40,000 cameras in 1979 to over 200,000 in 1980 and 1981. Polaroid introduced its flash model in 1981 and, in 1982, Kodak sales fell to 80,000. Mr. Samper, a Kodak marketing executive, attributed the bulk of Kodak sales in this time to the built-in flash. Professor Dolan agreed that, given the particular culture and religion of the region, Kodak cameras better met consumers' needs than Polaroid cameras for one or two selling seasons. The evidence does not show that Polaroid could have made these sales later in time. Therefore, I find that Polaroid could not have made all of those sales. [FN8]

The same two-year time lag before Polaroid introduced a camera with a built-in flash also existed in the United States and other countries, but in those markets, the built-in flash did not have the significance of the same transforming quality as in Saudi Arabia. Market research shows that some consumers preferred this feature, but there is no evidence that it was critical to their decision to purchase instant cameras and film.

Kodak Quality. Kodak argues that consumers preferred Kodak picture quality and that this preference was so strong that demand for instant photography would have shrunk without Kodak in the market. This is a narrow issue. Especially for consumers who have made no direct comparison, perceptions of quality are intimately associated with brand name. I have already examined that evidence, however, and found that the Kodak name, and all that goes with it, was not critical to sparking significant consumer interest in instant photography. To the extent consumers associated Polaroid with pack-era technology and Kodak with integral technology, quality was an issue. Again, I have examined the evidence of anti-Polaroid animus. Here, I am only concerned with the narrow question of how "quality" influenced consumers who compared Polaroid and Kodak integral products. The record shows that many Kodak customers did compare, usually at the

point of purchase.

Again, Kodak has done a good job of market research, showing that some consumers, both in the United States and abroad, preferred Kodak quality and cited it as a reason for choosing Kodak. Kodak has not convinced me, however, that consumers were so impressed with Kodak pictures that they would have foregone the purchase of any instant camera had Kodak products been unavailable. Polaroid outsold Kodak in every year of the infringement period, often by a margin of two-to-one. If Kodak pictures were of such better quality to keep some buyers out of the market without them, the opposite sales pattern would be expected.

Conclusion

*24 With the exception of the built-in flash in the Middle East, I find that Kodak's name, reputation, quality, and product features did not expand the demand for instant photography. Polaroid possessed adequate marketing capabilities in this regard.

(b) Kodak Sales Attributable to Kodak Distribution Sales Force and Dealer Support

Both Polaroid and Kodak recognize that differences in their relative abilities to distribute goods to the market are relevant to determining what sales Polaroid could have made but for Kodak's infringement. Kodak claims that its distribution strengths expanded the market for instant products, while Polaroid simply sees distribution as relevant to serving demand that already existed. It is difficult to discuss distribution in the nomenclature of economics. For instance, can it be said that because a camera is available in a department store, its mere presence causes a consumer to want the camera? Or is it that the consumer wants the camera but may never act on that desire until it is available in that channel? In either case, because the company not distributing in that particular channel would miss out on the sale, I need not decide that interesting question. For the moment, I am also putting aside the question of the advertising side effects of having products available in any particular channel. That matter will be discussed in section (c).

United States Distribution. Polaroid and Kodak distributed through the same channels in the United States: domestic dealers, catalog sales, military PX stores, food stores, department stores, mass merchandisers, and drug stores. For the first five years of the infringement period, both companies achieved product volume exposure of ninety percent.

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 17

This shows that both Kodak and Polaroid reached near total distribution and it was very easy for a consumer to find their products. In 1980, Kodak's product volume exposure began to decline and fell to about sixty-nine percent in 1985. This reflects Kodak's decision to pull back from the amateur market and dealer's decisions to de-stock the number two brand during the market decline. I conclude that Polaroid had full distribution capability throughout the infringement period.

Sales Force and Dealer Relations. Kodak claims that its presence expanded the market, and that it made sales Polaroid could not have, because Kodak employed more salespeople, trained them more extensively, called on its dealers more frequently, and maintained good relationships with them.

During the years of infringement Polaroid had a sales force dedicated solely to selling instant photography. Although the Kodak sales force outnumbered Polaroid's, [FN9] and Kodak representatives called on dealers more frequently, Kodak's salespeople were also responsible for selling other products. Professor Dolan testified that only about fifteen percent of Kodak's sales efforts were devoted to instant products. (TR 4027). Moreover, Polaroid also employed merchandise service representatives who delivered inventory to retail outlets, arranged stock, and trained counter personnel. Polaroid representatives provided in-store demonstrations of its instant photography system. Polaroid did not do extensive training with its sales force, but it only hired experienced salespeople. Perhaps more importantly, I am not convinced that the frequency and quality of sales calls significantly influenced the number of cameras sold. Indeed, one study concluded that sales clerks were generally neutral about instant products, but when clerks emphasized one brand over another, they more frequently pushed Polaroid. (PT 2413). Polaroid initially experienced difficulties with dealer relations. Beginning with the Focus '71 program, which offered year-end bonuses, payment of freight, and specialty lines, dealer relations strengthened considerably. Polaroid also participated in cooperative advertising where it shared the cost of a dealer's local promotion. In Europe, according to a Kodak document, Kodak's and Polaroid's image differed little, but, because Polaroid offered better financial terms, dealers did not actively push Kodak. (PT 2484).

*25 I find that Polaroid's initially troubled relationship with its dealers did not make them reluctant to sell Polaroid products in the face of

consumer demand. Setting aside the effect of in-store promotion on consumer demand, dealers responded to, and did not create, consumer demand. Kodak had good relationships with its dealers but did not prevent those dealers from de-stocking only Kodak products when demand slackened. After considering all the evidence, I conclude that Polaroid's sales force and dealer relations were fully capable in this regard.

International Distribution. Polaroid and Kodak sold instant products outside the United States through wholly-owned subsidiaries and distributors. [FN10] All witnesses agreed that it was advantageous to operate through a subsidiary rather than a distributor. [FN11] Subsidiaries offer more control, are more interested in the company's long term goals, and invest more in advertising. Distributors are independent organizations, usually more interested in short-term profits, and may not advertise as extensively. In sum, subsidiaries make it easier to distribute goods and cultivate demand.

In most of the large foreign markets such as Canada, France, Italy, West Germany, and the United Kingdom, Polaroid and Kodak operated through wholly-owned subsidiaries. Kodak and Polaroid subsidiaries used the same distribution channels in these countries. Although Kodak had manufacturing facilities in some countries where Polaroid did not, [FN12] and may have emphasized some channels more than others, I find that these differences did not influence demand. Polaroid opened one of its first foreign subsidiaries in Japan in 1960; Kodak had only a distributor there until 1984.

Outside of the six major markets (Canada, France, Italy, West Germany, the United Kingdom, and the United States) significant differences existed between Kodak's and Polaroid's distribution capabilities, differences which would have led to lost sales for Polaroid in certain markets. Kodak operated thirty-five overseas subsidiaries outside the six major markets, compared to Polaroid's fourteen. Kodak's subsidiaries were particularly strong in Latin America, the Middle East, and South Africa. Together these three regions accounted for thirty-seven percent of Kodak's international sales. (TR 7947-48).

In 1979, Kodak operated nine subsidiaries in Latin America where Polaroid had only two. Kodak outsold Polaroid in this region, capturing sixty-five percent of the camera market and sixty-eight percent of all film sales during the infringement period.

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 18

Polaroid experienced particular difficulty with its distributor in Mexico who teetered on the verge of bankruptcy in the early 1980s. For these reasons, I find that Polaroid did not have the capability to make all of Kodak's sales in this region. Considering all the evidence on this point, I conclude that Polaroid would have made thirty percent of Kodak's sales in Latin America.

*26 Kodak's presence was stronger in the Middle East as well. Polaroid only had distributors in this region whereas Kodak had four subsidiaries in the major markets of Iran (until 1979), Lebanon, Egypt, and Dubai. Kodak's operation in Saudi Arabia employed six people. In Dubai, Polaroid could not sell through Kodak distributor-owned outlets. Polaroid had problems with its distributors in this region, too. Not surprisingly, Kodak captured the larger market share in the Middle East, selling fifty-six percent of all cameras and sixty-one percent of all film. Considering that Kodak also expanded demand in the Middle East, particularly Saudi Arabia, by introducing the built-in flash two years before Polaroid, I conclude that Polaroid could only have made ten percent of Kodak sales in this region.

Protesting the government's policy of apartheid, Polaroid stopped selling products in South Africa in 1976. Kodak continued to sell in South Africa until 1987. Polaroid would not have made any of Kodak's sales in this region.

Premium Camera Sales. The premium channel is a method of selling goods to organizations that use the goods as gifts, incentives, or bonuses. Kodak was very active in the premium channel, both in the United States and abroad, beginning in 1977. During the entire infringement period, Kodak sold about four million cameras this way. As early as 1981, however, Kodak executives began to have concerns over premium camera sales. First, the cameras had to be extremely low-priced. In addition, market research showed that premium camera owners did not use as much film as those owners who purchased their own cameras or even compared to those who received a Kodak instant camera as a gift. Because of these problems, in 1984, Ms. Katherine Hudson, the head of Kodak's instant program, decided that Kodak should

discontinue premium sales.

From 1974 to 1982, Polaroid only sold a few cameras in the premium channel. Polaroid executives testified that they did not like selling cameras this way because of the low price and low film-use rate. Mr. Booth specifically excluded premium camera sales in his assessment of what sales Polaroid could have made in the absence of Kodak. (TR 2624). Dr. Young testified that he was not enthusiastic about this channel. (TR 1145). Polaroid devoted minimal sales staff to this market consistent with these views.

In 1983, however, partly as a result of research which led Polaroid to believe that the premium camera business might be profitable, the company stepped up its participation in this channel. In the United States, premium sales went from 58,600 in 1982 to 629,500 in 1985. Even so, upon reflection at trial, Mr. Booth stated that "it was not the type of market place that is worth the energy and effort to go after in great number." (TR 2294).

I find that in a world without Kodak, Polaroid would not have made all the sales that Kodak made through this channel, especially in the years 1977-1982. Polaroid would have made some of the sales, because it did use this channel, but the testimony of Polaroid executives convinces me that the company would never have participated fully. Therefore, for the years 1977-1982, I find that Polaroid would have made ten percent of Kodak's premium sales. Beginning in 1983, I find that Polaroid would have increased its participation, as it did historically, and would have made fifty percent of Kodak's sales. After 1983, Polaroid was fully active in this channel and I believe it could have made all of Kodak's premium sales.

Conclusion

*27 For the most part, Polaroid's marketing capability was adequate to meet the demand for instant products but for Kodak's infringement. Polaroid would have been unable to make Kodak's sales in the premium channel, the Middle East, Latin America, and South Africa, as follows:

Premium Sales Lost (90%, 50%, 0%)	2,910,150
Middle East Sales Lost (90%)	1,085,642
Latin American Sales Lost (70%)	1,490,609
South African Sales Lost (100%)	587,667

Not Reported in F.Supp.
 1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481
 (Cite as: 1990 WL 324105 (D.Mass.))

Page 19

Total Camera Sales Lost

Due to Marketing 6,074,069
 (rounded off)

The resulting loss in film sales is discussed in Section V.

(c) Effect of Two Competitors Advertising and Promoting Instant Products

Except in certain foreign markets, Kodak does not claim that its advertising and promotion was unique or better than Polaroid's. There is no dispute that Polaroid spent more on advertising than Kodak in every year of the infringement period and outspent Kodak two-to-one over the entire period. Moreover, Polaroid agrees that it would have had to spend even more on advertising to make additional sales. Polaroid included this cost in its lost profits calculation. In contrast, Kodak claims that even if Polaroid spent as much as the two companies combined it could not have duplicated the impact of two competitors' advertising. Kodak claims Polaroid alone would have been unable to generate the free media attention, dealer shelf space, and in-store display that Polaroid and Kodak jointly achieved for instant photography.

Professor Buzzell testified that when a competitor like Kodak enters a mass market like this one, a lot of "hype" is generated. News media report the story. Dealers stock both brands and may display them side by side. Consumers become engaged in the comparison and pay more attention to the market. Even some Polaroid executives believed that Kodak's advertising in the first few years of its entry expanded demand for instant products. Mr. Wensberg testified that:

It is my belief that [the dual impetus of the heavier Polaroid advertising and the advertising which Kodak did] expanded [the market] temporarily, yes, and it is my belief that that was a short-term gain which was largely negated by other forces that were taking place in the marketplace.

(TR 993). Mr. McLaughlin, Mr. Brewer, and Mr. Voekel, who worked with Polaroid subsidiaries in Europe, made similar statements. (DF 60,528; DF 60,620; DF 60,532). Even Professor Dolan thought "that advertising spending and the publicity surrounding the entry of Kodak into the market, it [sic] had some impact on people's awareness of the instant photography category." (TR 4293). Of course, Professor Dolan also testified that additional Polaroid advertising could compensate for this effect.

Alone in the market, Polaroid could not have commanded the shelf space, point-of-purchase promotion, and amount of in-store demonstration that Polaroid and Kodak together achieved. This is true even if Polaroid had paid for additional trade support. Two Polaroid television commercials in a given evening would not engage the attention of consumers in the same manner as one Kodak and one Polaroid commercial. A synergy is created when a competitor enters a mass media market and the whole is soon greater than the sum of its parts. I find that the instant photography market was subject to this phenomenon.

*28 Still, it is impossible to gauge the magnitude of the two-competitor effect. Professor Dolan testified that according to contemporaneous market research which assessed the impact of advertising, neither consumers' brand awareness nor purchase intention increased as a result of Kodak's entry. However, these studies focused only on Kodak and Polaroid instead of assessing whether awareness or purchase intention for the category as a whole had increased. Awareness of instant photography was nearly 100% even before Kodak entered, so it is not surprising that it did not increase. The purchase intention studies answered the question, "If you were to buy an instant camera today what brand would you buy?" The more helpful question is, "How likely is it that you will purchase an instant camera soon?" In addition, Professor Buzzell challenged the relevance of Professor Dolan's conclusions regarding purchase intention, finding that, according to Professor Dolan's evidence, it had actually decreased between 1974 and 1978. There was a small increase in purchase intention in the true sense in France and Italy between May and September 1977. (PT 2532). However, no witness analyzed the significance of this change.

I have examined other evidence that helps me quantify this effect. In response to my question, Professor Baumol agreed that his market expansion variable may have partially captured this effect when he calculated that the market expanded seventy percent with Kodak's entry. Because Professor Baumol did not find market expansion after 1981, it coincides well with Kodak's decision to sharply reduce promotion efforts around 1981. Even if I found that measure reliable, it would not tell me what portion resulted from the dual-advertising phenomenon. Kodak proffers many other reasons for the expansion

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 20

which I have rejected. Professor Dolan opined that the portion of historical sales which he could not attribute to advertising, but he concluded that Polaroid could make up that difference by spending more advertising dollars. Professor Fisher concluded that advertising levels had no effect at all on the demand for instant cameras, a conclusion which I cannot accept.

Conclusion

[6] Having no firm basis upon which to judge what portion of sales Polaroid would not have made absent the dual-advertising phenomenon, I must let the burden of uncertainty fall upon the infringer. Neither party has given me a reasonable analytical tool for sorting out this effect. The consumer's purchase process is immensely complicated and it may be impossible to identify individual motives except in a very general way. [FN13] Therefore, I conclude that Polaroid's profits should not be reduced to account for the dual advertising effect.

Kodak also claims that in some of its foreign subsidiary markets, its advertising strategies were more in tune and targeted at the particular culture and thereby created interest in instant photography. Polaroid's advertising was not as effective, Kodak argues, because it employed, essentially the same basic themes used in the United States and was not tailored to foreign markets. I find nothing in the record to suggest empirically which approach was best, and I do not find that Kodak's advertising in these markets induced sales that Polaroid's advertising could not have produced.

(d) The Evidence of Market Expansion

*29 After considering the means by which Kodak claims it expanded the market and having arrived at the conclusion, with a few exceptions, that Kodak did not influence the market in a way that Polaroid could not duplicate, I turn now to examine Kodak's empirical evidence that the market did, indeed, expand by its entry.

Kodak offers three types of information to show that the market expanded: (1) contemporaneous research that Polaroid and Kodak purchasers were drawn from different groups; (2) contemporaneous predictions and conclusions about market expansion by Polaroid executives and outside financial analysts; and (3) Professor Baumol's econometric model which, by estimating the influence of various factors on the demand for instant cameras, concluded that Kodak expanded the market so substantially that Polaroid would have captured none of Kodak's sales from 1976 to 1978, a small percentage in the middle years, and all of Kodak's sales in the last three years.

The contemporaneous statements that Kodak offers do not compel me to conclude that the market expanded. First, the contemporaneous predictions by Polaroid personnel were largely fueled by the belief that Kodak would be bringing a unique product to the market. In some cases, statements were made in order to quell fears that Kodak's entry might have a devastating impact on Polaroid. In addition, the statements were merely guesses about the future. Second, the concurrent statements of Polaroid executives and conclusions of analysts that the market had expanded are not as reliable as my hindsight review of the facts. Moreover, some speakers had different concepts of market expansion; some statements imply that the speaker considered additional Kodak advertising--not just the synergistic effect--as a market expanding mechanism.

Kodak also presented the results of research it claims tends to show that Polaroid and Kodak drew their customers from "somewhat different groups." (TR 11152). One study, conducted between April 1976 and January 1978, surveyed 25,000 registered owners of Kodak instant cameras and reported that seventy percent of these purchasers had never owned an instant camera before. (DF 61,574). A 1979 survey of an unspecified number of new Polaroid purchasers found that only thirty-five percent had never owned a *Polaroid* camera before. (DF 20,097). From this, Kodak concludes that it drew an untapped pool of new purchasers into the market that Polaroid could not have exploited. I find otherwise. These two studies are not comparable, as they were conducted at different times and with apparently different sample sizes and types. They catch only a small snapshot of time. They do not specify, nor does Kodak offer, any explanation for the phenomenon it claims they expose. Standing alone, they cannot establish market expansion.

Professor Baumol's models showing market expansion are also problematic. Using multiple regression analysis, Professor Baumol attempted to ferret out Kodak's influence on the market by estimating the relationship between certain key variables and the demand for instant cameras. He then introduced a variable to account for Kodak's presence and found that it demonstrated a significant effect on the market. These models are quite complicated and so I will start by explaining, as simply as I can, how the models work. [FN14]

*30 Professor Baumol reviewed the facts of this case and made various assumptions about what forces were operating in the instant camera marketplace. Although in the beginning he identified more variables, in the end he chose five: (1) integral camera prices; [FN15] (2) the per print price ratio of integral and conventional film; (3) 35mm wholesale camera prices; (4) dollars spent on total

Not Reported in F.Supp.

Page 21

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

integral advertising; and (5) Kodak market expansion. For each variable except market expansion, the model calculated the effect on camera sales of an increase or a decrease in the independent variable. By taking into account all four relationships at once, the model generated the relative influence of each variable as it operated historically. This is the basic technique of econometrics.

In his standard demand model, Kodak Model I, Professor Baumol introduced a "dummy variable" to capture the effect of Kodak's market entry. Instead of using a value, such as the price of 35mm cameras, he inserted a "0" for those years when Kodak was absent and a "1" when it was present. The model then answers the question: what possible relationship or correlation exists between this difference and the demand for cameras that best fits the facts? If that correlation is strong the difference is significant. Professor Baumol found a significant relationship between Kodak's presence in the market and camera demand in the first six years of the infringement period. In the later years, the coefficient was not statistically significant; any influence on demand as a result of the difference was just as likely due to chance as to Kodak's presence.

Professor Baumol freely admits that any model is colored by the assumptions upon which it is based and by the influences the model builder chooses to include or to omit. Although Professor Baumol chose to include market expansion, I have found, with a few exceptions, that there was no market mechanism unique to Kodak which the facts show could have expanded the market. Although I cannot paint a perfect picture of the market from the testimony of fact witnesses, contemporaneous documents, and market research, I find that evidence much more reliable than even the best econometric model. The direct evidence is, after all, the factual basis of the case, not some approximation built on facts. Besides being contrary to the facts, the extreme results of Professor Baumol's model--that Polaroid would have captured none of Kodak's sales between 1976-1978 and only a small percentage from 1979-1983--add to my conviction that it is unreliable. I, therefore, reject its conclusions as contrary to other evidence which I find more credible. [FN16] Even Professor Baumol's final and conservative conclusion that Polaroid could only have captured twenty-five percent of Kodak's sales is far removed from my view of the facts. Still, because I respect Professor Baumol's expertise and he did include the dummy variable for market expansion and find it significant, I will attempt to explain why he might have found this effect.

*31 First, both Professor Baumol and Professor Fisher agreed that market expansion cannot be measured

econometrically if all one considers is the demand for low- and medium-range cameras. (TR 11193; TR 5103-4). There are not enough years when low- and medium-priced cameras were available and Kodak was not in the market to make the comparison reliable. So, in order to measure market expansion, Professor Baumol included high-priced instant cameras. He was thereby able to include the years 1973-1976 as "0" years and make the statistic reliable. The model therefore compares demand in two different eras: when low- and medium-range cameras were not in the market and when they were available. Supposedly, the market expansion variable will not capture any change in demand due to price, because the price variable will measure that effect. I believe, however, the dummy variable could be capturing something else entirely: a change in the marketplace that is not easily quantifiable-- instant photography's metamorphosis from a sophisticated picture-taking technique for the wealthier buyer or the photography buff to a fun system accessible to everyone. When Polaroid and Kodak offered low- and medium-priced cameras, they did more than lower prices; they made cameras available to more people thereby changing the image of the entire field. Call it a fad. Call it the development of a mass market. For reasons not having to do only with Kodak, the market changed. Since it changed at the same time Kodak entered, the market expansion variable may be capturing this sensation.

While I do not accept these models in this case, I am not critical of the field of econometrics as a whole. I believe it can provide valuable insight into complicated matters. However, in this case the models contain assumptions contrary to the facts and achieve extreme results which by their very nature are suspect. Perhaps the inner workings of the models, which I cannot fully comprehend, are biased. Perhaps the instant photography market does not lend itself to mathematical interpretation. Whatever the reason, I cannot adopt Professor Baumol's model as evidence of market expansion.

Conclusion

But for Kodak's infringement, Polaroid had the marketing capability to make most of Kodak's sales. I find that while Polaroid was not capable of making all Kodak's sales in the premium channel and in some foreign markets, there was nothing unique and critical to Kodak's entry such that without its infringement, demand would have been diminished.

2. The Market of the Future, According to Polaroid

Having considered Kodak's claim that the market would shrink without them, I now turn to Polaroid's claim that without Kodak the market would have been more

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 22

profitable and would have extended far into the future. Polaroid's case is based, in the first part, on their assertions that Kodak's behavior in the market forced them to lower their prices and that without Kodak, they would have charged considerably more for their cameras and film. Polaroid also claims they would have introduced the OneStep camera one and one-half to two years later, allowing them to capitalize on Pronto! sales, produce a better OneStep and avoid the boom (and therefore, the fall) of instant sales. Polaroid uses the econometric model of Professor Fisher to show how their alternative strategy would have generated demand for cameras and film which would result in profits of over \$3.9 billion dollars. In Section (a), I examine Polaroid's historical pricing behavior and in Section (b), I discuss generally the relationship between higher prices and demand in this market. Section (b) also includes a discussion of Professor Fisher's model.

Section (a): Polaroid's Historical Pricing Behavior

*32 The key to Polaroid's alternative damage scenario is the proposition that Kodak caused them to lower their prices and its corollary, that higher prices would have meant more profit. To some degree, whether Kodak caused Polaroid to charge less for cameras is irrelevant if I conclude that the higher prices Polaroid proposes would not have been more profitable. Still, since I find that Polaroid lowered their prices consistent with their past behavior as a monopolist and in response to the market, irrespective of Kodak's influence, the first proposition sheds light on the second.

The record contains a great deal of evidence from which one can infer that Polaroid, even without Kodak in the market, would have lowered prices and introduced the OneStep as they did during the infringement period. Although Polaroid may not have lowered prices as far or as fast as they did historically, it is important to note that the general pattern was not new to Polaroid. Polaroid was aware of the price points in the industry; it knew that the majority of camera sales were made with cameras priced under \$50. In the pack era, Polaroid offered successively lower-priced models. It sold the Swinger for \$20 in 1966. It sold the Colorpack II in 1969 for about \$30. It offered other cameras in this price range. (TR 227-28). Mr. McCune testified that Polaroid was aware that "there were parts of the public who would respond to low-price products that didn't respond to middle-price products." (TR 228).

Polaroid followed a pattern of quickly introducing lower-priced models with the folding SX-70. Although Polaroid did not achieve full distribution of the deluxe SX-70 until 1974, it introduced the lower-priced Model 2, with reduced margins, in that year. The Model 3 was

introduced in 1975 at a \$13 loss. In an August, 1974 memo to Polaroid top executives, Peter Wensberg justified introducing the Model 2 and 3 with "unacceptable margins" because it would increase camera volume as well as generate additional film sales. (DF 20,244). He testified that Polaroid believed it was not profitable to raise prices:

"But by increasing prices, we obviously felt we would not sell as many cameras; hence, not improve camera division variance; hence not achieve incremental film sales." (TR 910). Polaroid knew the advantages derived from lowering prices and historically followed a pattern of doing so.

Polaroid took the first leap into mid-priced integral cameras with the Pronto!. The Pronto! was specifically introduced to have wider appeal among consumers. Although Dr. Land did not want to introduce the hard-bodied line, Mr. McCune, who became president in late 1974, advocated a mid-priced model. Pronto!'s introduction was not influenced by Kodak even though Polaroid had strong signals as early as 1970 that Kodak planned to enter the market. (TR. 344). Kodak reduced the initial price of the EK-4 and EK-6 models because of Pronto!'s low price.

*33 Although Polaroid had no firm plans to introduce the OneStep in 1977, the elements of a low-priced model were being explored. This is the reason Polaroid was able to respond so quickly to the Handle. (TR 234-35; 341-42). Mr. Bassett, Polaroid's sales forecaster, recommended to Mr. Wensberg that Polaroid "[i]ntroduce an under \$25.00 SX-70 type camera early in 1977." (DF 70,076B). Mr. Wensberg also advocated a product priced under \$50. (DF 20,279). Throughout the infringement period, whenever Polaroid introduced lower-priced models, Kodak executives felt they had to respond because the Polaroid cameras at comparable prices usually had more features. (TR 7816- 30). Moreover, some price cuts Polaroid instituted were deceptive as the cheaper product often offered fewer features. The 1978 Pronto RF price cut for example, occurred after Polaroid removed the camera's tripod mount and timer.

Polaroid claims it was unable to raise its film price as high as it would have liked because of competition with Kodak. Yet, well before Kodak's entry, Polaroid knew that "the strongest reason consumers do not buy a Polaroid camera is due to our film price." (DF 61,606, Tab 9, see also Tab 11). Both companies priced their film almost identically throughout the infringement period. In only one instance was there was a nine month delay between when Polaroid raised its film prices and Kodak followed. Kodak also initiated several price hikes

Not Reported in F.Supp.
 1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481
 (Cite as: 1990 WL 324105 (D.Mass.))

Page 23

which Polaroid followed. Mr. Brewer stated:

From my personal perspective, we basically set our prices predicated upon what we felt would have impacted both our volume and margins; and the Kodak film price, to my recollection, they were normally quite responsive to whatever we did, in terms of if we increased our price, the sense was that Kodak increased their prices. So the sensitivity level in pricing was not very intense at all in the film area.

(DF 70,007A). Still, Polaroid claims it feared raising prices because of Kodak.

From about 1980 on the foremost concern of Polaroid executives in pricing film was the competition with conventional photography, specifically, 35mm cameras and film. In 1981, Mr. Booth reported to Polaroid's board that "[the] relative price of an instant picture to a conventional picture is a major concern" and that "if we raise our prices much more than five percent per year we will widen the ratio of instant to conventional and it is already very high." (DF 10,413 at 0838-39). In 1982, Polaroid's Director of Strategic Planning wrote a series of memoranda concluding that the widening gap between the price per print of instant and conventional photography "had a substantial negative effect on Polaroid's share of the amateur photographic market." (DF 61,606, Tab 6). Many other Polaroid reports, memos and studies report the concern of the relative film prices between instant and conventional. (See, e.g., DF 61,606 Tab 22, Tab 27). This constraint on film pricing would have been present without Kodak and I believe Polaroid's response would have been present without Kodak and I believe Polaroid's response would have been the same.

Conclusion

*34 After reviewing all the evidence in this regard, I find that even in Kodak's absence Polaroid would have lowered camera prices, introduced the lower-priced OneStep and felt constrained regarding film prices just as it did historically. Polaroid claims that it would not have lowered prices but the proof is to the contrary. The decline in instant film prices cannot be laid at Kodak's door. The market was changing, influenced both by the competition from conventional photography and changing consumer perception of instant photography. Perhaps Polaroid would not have lowered prices as quickly or significantly as they did. Unfortunately, Polaroid has not made such a modest and reasonable claim. Instead, it has presented scenarios which include large price increases on both cameras and film. This Court has neither the evidence nor the tools to generate a demand curve based on more modest and more realistic price increases.

Section (b) The Effect of Higher Prices in the Instant Photography Market

Although Polaroid was pricing its cameras and film independent of Kodak, that finding is not crucial because I also find that the higher prices Polaroid says it would have charged would have depressed demand so substantially that the strategy they historically pursued is actually the more profitable one.

If Polaroid had raised its prices as high as they claim, demand would have been substantially diminished. Polaroid presented basically two alternative pricing strategies. The prices it originally planned to charge for cameras and film were generated by Professor Fisher and in one scenario ranged from fifteen percent to 113% over historical prices. [FN17] (DF 61541; Tr. 11667). In response to my question during his direct examination, Mr. Booth testified on re-direct that Polaroid would have charged \$10 more for each camera, but for Kodak. Mr. Booth also testified that film prices would have risen at ninety percent of the Consumer Price Index in normal years and eighty percent in years of hyper-inflation. Historically, Polaroid priced its film at about fifty percent of the Consumer Price Index. (PT 2303; TR 2462-64).

Despite these higher prices, both Professor Fisher and Mr. Booth conclude that Polaroid would have been able to sell substantially more cameras. Mr. Booth predicted that from 1976 to date, Polaroid could have sold all the cameras it historically sold and seventeen to twenty million more. Even with the higher prices on film, he believes they could have sold 300 to 350 million additional packs of film. Professor Fisher concludes that from 1976 to 1990, Polaroid could have sold essentially all the cameras that it sold historically and those that Kodak sold, all at his higher prices. I reject both of these conclusions because they contradict the overwhelming evidence of extreme price sensitivity in this market. Professor Fisher's conclusions also conflict with the substantial evidence that film and camera prices were seriously constrained after 1980 by the increase in the relative value of conventional photography.

*35 As I discussed in Section (a), Polaroid was well aware that raising prices would diminish demand. Numerous Polaroid documents, including market research studies, establish that demand was very sensitive to price, especially to the price of film. (For a list of some relevant excerpts in this regard, see DF 61,606). Since Kodak left the market and Polaroid has raised its camera and film prices, sales have dropped significantly. (DF 61,025; DF 61,034; TR 8169-71). Professor Dolan underscored this price sensitivity in his analysis of what affects demand. He demonstrated how you could explain almost all of the boom and fall of instant photography simply by tracing

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 24

price changes. (TR 4253-81). Professor Baumol also concluded that higher film prices would have a drastic effect on demand. One of his scenarios showed that if Polaroid raised its prices as little as ten percent, revenues on cameras and film would decrease by ninety-one percent. (DF 61,622).

Higher prices and diminished demand can result in higher profits. An increase in profit per camera can outweigh the smaller profit realized from a larger number of sales. But this fact holds true only to a certain level, for if demand falls significantly, profits will also fall. In light of all the evidence on this point and given the high prices Polaroid used in its demand scenario, I find that they would have generated less profit pursuing the higher pricing strategy than the strategy it pursued historically.

Polaroid's ability to charge higher prices was and would be seriously constrained after 1980 by competition with conventional photography, chiefly the 35mm camera system. In the late 1970s, 35mm cameras commanded an increasingly larger market share. In the period 1979-1982, average annual sales of 35mm cameras totalled about four and a half million units, up from about a million units annually in the period 1976-1978. By 1979, 35mm camera sales accounted for sixty-four percent of all camera dollars spent by consumers. (DF 61,742, Tab 1). Other conventional photography products also competed with instant, but not to the same degree. (TR 2556; DF 60,1744).

Consumers were attracted to 35mm photography because of the high quality that an amateur photographer could achieve. When 35mm manufacturers began to add features such as auto-focusing, auto-exposure, auto-load and auto-advance, the chance of consumer error decreased. Increasingly, the kind of photographs consumers took with these cameras became the standard of what constituted a good, acceptable quality print. In this way, they began to compete with instant even before the prices became more directly comparable. In internal reports during this time period, Polaroid recognized that 35mm had become the new industry standard. (E.g., PT 2293; *see also* TR 1660).

The price of 35mm cameras declined on the order of thirty to forty percent in the early 1980s. Average customs values on 35mm single lens reflex ("SLR") cameras declined by thirty-six percent from 1976-1985. As advertised in the New York Times, the price of the Cannon Sure Shot, an immensely popular non-SLR camera, declined from \$144 in 1980 to \$103 in 1983, or twenty-eight percent. In 1983, non-SLR cameras were offered for as low as \$70. Although these cameras were still above the lowest-priced instant cameras, the relative

value placed them directly in competition. In 1983, Polaroid asserted:

*36 The decline in the demand for the instant category as a whole, rather than for Polaroid in particular, points toward conventional cameras, especially 35mm cameras, as Polaroid's main competition rather than Kodak instant.

(DF 61,742, Tab 5). Other Polaroid documents show that in the minds of Polaroid executives, the difference in quality between conventional and instant prints was a major factor in the declining demand for instant. (E.g., DF 61,742, Tab 2; DF 21,054). Mr. Booth testified that he believed that from 1980 onwards 35mm quality and convenience surpassed the quality and convenience of instant prints, while the price for instant prices were higher. (TR 2538-39).

The cost per print of instant became more expensive relative to conventional during this period. In 1981, Mr. Booth reported that the ratio was an "already high" two-to-one. The ratio increased partly because the cost of conventional photofinishing was declining. First, color paper costs were dropping. Second, with the proliferation of photo-developing kiosks in the 1970s and minilabs in the early 1980s, competition between photofinishers was keen and drove the price down. Polaroid executives were concerned about this ratio and knew it affected the purchase of both cameras and film. (E.g., PT 2293; DF 60,174).

Developments in 35mm photofinishing contributed to the declining demand of instant and reduced Polaroid's ability to raise prices in any "but for" world. First, it became more convenient. The number of minilabs grew from 1000 in 1980 to 14,000 in 1988; it was easier for consumers to find a film developer. Second, the time to develop pictures went from a week, to three days, to twenty-four hours and finally, to an hour. Consumers could now get high quality prints in a very short time, cutting into instant's traditional domain. Since photofinishers were often camera retailers, too, and there is also some evidence that they were more likely to stock and sell conventional cameras.

I find that Polaroid would not have been able to raise its prices significantly without greatly reducing demand. Not surprisingly, Professor Fisher reached a different conclusion. I have considered his analysis in my review of the record and I reject it as being unreliable and contrary to the bulk of evidence in this case. I do not have the skill or the obligation to parse his model to show why we come to different conclusions. Professor Christiansen, an econometrician who testified for Kodak, dissected the intricacies of Professor Fisher's model and

Not Reported in F.Supp.

Page 25

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

exposed its unstated assumptions, biases and errors. [FN18] Below, I will attempt to explain in a broad, non-technical sense why I find his model unreliable.

Professor Fisher constructed a model reflecting his judgments about what influences the demand for instant cameras and film. His work includes two models: a "film burn" model which estimates the number of film packs that a camera owner will use over the life of a camera, and a camera demand model which calculates the number of cameras that consumers would have purchased given a certain set of camera and film prices and introduction dates. Professor Fisher arrived at his model just as Professor Baumol did: by making assumptions about the influences on demand, entering the historical values of those influences and arriving at a mathematical relationship between the influences and the number of cameras that were purchased. Professor Fisher then took one further step and used this framework of relationships to predict the future. By changing the price and the introduction dates, he claimed that he could show how demand would have been affected by Polaroid's alternative strategies. Professor Fisher concluded that by pricing its cameras and film higher and delaying the introduction of the OneStep, Polaroid would have been able to make between \$3.1 and \$3.5 billion dollars in additional sales of cameras/film. [FN19]

*37 In Professor Fisher's model, Polaroid charges more in the Kodak-free world, and yet sells the same number of cameras from 1976 to 1990 that Polaroid and Kodak sold together from 1976 to 1985. The model achieves this result because price is the only factor which ultimately influences demand. The model assumes that consumers have in mind a price which they will pay for an instant camera system. The price includes both the camera and the number of film packs the consumer is estimated to use from Professor Fisher's film burn model. [FN20] The consumer compares her "reservation" price to the system price and if it is the same or less, she becomes, in model parlance a "probable buyer." Once a probable buyer, only "search rate" ultimately influences when the consumer will purchase a camera. The search rate assumes that in each year only twenty-one percent of the probable buyers will purchase. The search results in a mean waiting time of 4.5 years before purchase. [FN21] In this manner, Professor Fisher's model pushes off demand into the future; regardless of the different prices and dates used, the typical pattern of results is lower sales in the beginning years and higher sales thereafter.

In this way, Polaroid is able to have its cake and eat it, too; they can exploit those who would pay more and capture the rest later. This is really just a version of the "skim pricing" which monopolists often employ. The

market would not have worked in the way Professor Fisher envisions, however, because consumers' willingness to pay for instant photography was changing. The market was heavily influenced by the relative value of conventional photography. Professor Fisher's model does not adequately account for that variable.

Professor Fisher's attempts to capture the effect of competition from conventional photography are minimal and misguided. His model includes a variable reflecting the number of 35mm, instamatic, and disc cameras purchased. Not only is this contrary to the way in which Polaroid documents routinely discuss the effect of conventional photography, Professor Christiansen points out that measuring competition by stock rather than price is wrong and leads to error. (TR 11549-50). Not surprisingly, Professor Fisher found no effect from conventional photography on the sales of low-priced instant cameras. As a result, none of his pricing scenarios captures any competition at this level. This conclusion contradicts the views of Polaroid executives who reported that conventional photography products competed with instant products at all price ranges.

Professor Fisher's model does not account at all for the competition between the relative price per print between instant conventional pictures. As I have already found, Polaroid believed conventional film with processing competed directly with instant film. Professor Fisher's own consulting group, Charles River Associates, determined that seventy-seven percent of Polaroid households also owned a conventional camera and that consumers can and do choose between whether to use conventional or instant film. (TR 11290). In his scenarios, Professor Fisher assumed that conventional film prices constrained Polaroid's ability to raise its own prices, yet the scenarios do not consider that constraint until 1985, considerably later than the evidence shows it was significant to consumers and to Polaroid officials.

*38 By not capturing the profound effect of the competition from conventional products, Professor Fisher overestimated the prices Polaroid could have charged for instant products. He also overestimated how much consumers valued the technological changes of the Sun system. In his model, consumers were assumed to change their valuation of instant photography and therefore be willing to pay more for an instant system after the Sun introduction; this allows Polaroid to raise its prices even higher without losing sales. Yet, the record shows that consumers did not view the Sun system as new technology. Sales were poor and there was no evidence of market expansion. Eventually, Polaroid lowered its prices on this line in order to stimulate sales.

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 26

Other elements in Professor Fisher's model run counter to the evidence. Professor Fisher found no effect on demand from advertising--contrary to the opinion of almost every other witness who testified about the market. Professor Fisher found that the price of film did not affect the number of packs that an owner would use over the camera's lifetime--contrary to the opinion of almost every other witness who testified about the market. The packs per camera total included in the system price in Professor Fisher's model is not susceptible to changes in film price--contrary to the opinion of almost every other witness who testified about the market. Professor Fisher had incomplete data for markets outside the United States and yet felt confident to model the sales in those countries. These factors and others lead me to find Professor Fisher's model unreliable in predicting demand.

The profits which Professor Fisher believes Polaroid would have realized without Kodak are so high, given the fact that both Polaroid and Kodak lost money in the real world, that they cast doubt on the credibility of his analysis. Professor Fisher supported his results by pointing out that his calculations generate profits as a percentage of sales that are consistent with Polaroid's experience in the pack era. Irrespective of Kodak's entry, however, there are so many differences between the market in the 1950s and 1960s and the market from 1976 to 1985 that I do not find this comparison helpful. In the 1970s, Polaroid began manufacturing almost all of its own components. In the 1970s, conventional photography rose in value to compete with instant. Professor Fisher has not acknowledged these changes.

Mr. Booth also believed that higher prices would not significantly affect the total demand. For some of the same reasons that I reject Professor Fisher's conclusions, I also reject Mr. Booth's. Chiefly, the demand at those prices is too high given the price sensitivity of demand in the instant photography market. However, I am limited in my analysis of Mr. Booth's opinion because he did not explain his methodology or assumptions. Of course, in the process of considering Professor Fisher's model I have encountered the "essence" of Mr. Booth's numbers, but the flaws of that analysis belong to Professor Fisher and not to Mr. Booth.

Conclusion

*39 It would be ridiculous to conclude that Kodak's presence in the market did not influence how Polaroid conducted its instant business from 1976 to 1985. Other than losing the sales that Kodak made, however, Polaroid has not proven additional damage. It has not shown that it would have charged higher prices. It has not proven that it would have introduced the OneStep later. Even if I were to conclude that Polaroid would have waited to

introduce the OneStep, it has failed to prove that would have resulted. Polaroid failed to prove, even in a rough way, what those consumers who historically purchased OneSteps and Handles would have done in a world without Kodak. Even giving Polaroid every benefit of the doubt, the Court is unable to conclude that the company would have reaped greater profits. Liability does not extend to speculative damages. Yarway, 775 F.2d at 275; Bio-Rad, 739 F.2d at 616.

Polaroid has failed to prove that higher prices would have brought it greater profit or that Kodak caused price erosion. As a result, Polaroid has not proved that its damages extended beyond 1985; in its proposed scenario, the high prices and delayed introductions would have increased demand from 1985 to 1990. Polaroid's prices after 1985 were not affected by Kodak's infringement. Polaroid is only entitled to lost profits from the sales Kodak made minus those sales Polaroid would have been unable to make because of limits in its marketing capability.

IV. POLAROID'S MANUFACTURING CAPACITY *Legal Principles*

Factual Findings & Conclusions

A. Film Manufacturing

Introduction

1. Polaroid's In-Place Capacity: Film

a. In-Place Capacity of Assembly

Machines

No Coverage

No Material Time

Engineering Updates

Conversion to Other Products

b. In-Place Capacity of Components Positive Sheet

Negative Base

New Bedford Negative Coating Batteries

2. Polaroid's Potential Capability

a. Film Assembly Machines

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 27

1977-1978

Time Required to Bring Into Production

Machine Starting Dates

1979-1980

1981-1985

Conclusion

B. Camera Manufacturing

Introduction

1. Polaroid's In-Place Capacity

1976

1977-1980

1981-1985

Legal Principles

To recover profits on lost sales, in addition to marketing capacity, Polaroid must also show that it had the ability to manufacture sufficient cameras and film to meet Kodak's sales volume. *State Indus.*, 883 F.2d at 1577; *Datascope Corp.*, 879 F.2d at 825; *Water Technologies Corp.*, 850 F.2d at 672. This showing is an integral part of proving that Polaroid is entitled to lost profits; if Polaroid could not manufacture the product to meet demand, it cannot prove that it would have made the sales in the "but for" world.

While Polaroid is not required to show it had empty factories waiting for additional work, see *Livesay Window Co.*, 251 F.2d at 473, it must prove, by a preponderance of the evidence, that it had at least the potential capability to meet the demand. *Bio-Rad Laboratories, Inc. v. Nicolet Instrument Corp.*, 739 F.2d 604, 616 [222 USPQ 654] (Fed.Cir.), cert. denied, 469 U.S. 1038 (1984). Accord *State Indus., Inc. v. Mor-Flo Indus., Inc.*, 8 U.S.P.Q.2d 1971, 1979 (E.D.Tenn.1988), aff'd in part and vacated in part, 883 F.2d 1573 [12 USPQ2d 1026] (Fed.Cir.1989); *Kori Corp. v. Wilco Marsh Buggies & Draglines Inc.*, 561 F.Supp. 512, 527 [217 USPQ 1302] (D.La.1981), aff'd, 708 F.2d 151 [219 USPQ 286] (5th Cir.1983), transferred to 761 F.2d 649 [225 USPQ 985] (Fed.Cir.), cert. denied, 474 U.S. 902 (1985); *W.L. Gore & Assoc., Inc. v. Carlisle Corp.*, 198 U.S.P.Q. 353, 362 (D.Del.1978). Although both Polaroid and Kodak agree that the law does not require Polaroid to have in place the ability to make the combined volume, they disagree about what

kind of showing will satisfy Polaroid's burden of proving that it had the potential to meet the demand. This may be a simple dispute about whether Polaroid has met its burden or it may be a genuine dispute about the standard to be applied. In either case, the issue deserves some preliminary discussion.

*40 [7] The seed of this dispute is that Polaroid's in-place manufacturing capacity was not sufficient to satisfy the combined demand which came fast and furious in the first three years of the infringement. Polaroid has not convinced me that the opportunity to make Kodak's sales existed at any other time than when Kodak historically made the sales. (See Part II). Therefore, Polaroid must necessarily present an expansion scenario which shows what steps, including some time-consuming capital investment, it conceivably could have taken to meet the demand.

One interpretation of Polaroid's proffer on this issue is that Polaroid believes that if the patentee can put forward any possible expansion scenario that meets the production requirements, regardless of how unlikely or unreasonable it may be, it has met its burden. [FN22] In other words, Polaroid may be urging that if it theoretically could have taken steps to produce the combined volume, it has proven it could have made the sales. During trial, Kodak commonly referred to this approach as the *could have* standard. Kodak claims that what *could* have done is irrelevant; Polaroid must show, by a preponderance of the evidence, what it *would have* done. Kodak argues that Polaroid must show exactly why, when, and how it would have increased capacity. Kodak argues that the record shows a disparity between what Polaroid would have and could have done, given Polaroid's history of inaccurate forecasting, conservative decisionmaking, and other quirks of its corporate personality.

Neither claim is quite right. The case law does not define potential capability very clearly. To be sure, patent owners have not been held to the type of absolute proofs Kodak desires. See, e.g., *King Instrument Corp. v. Otari Corp.*, 767 F.2d 853, 864 [226 USPQ 402] (Fed.Cir.1985), cert. denied, 475 U.S. 1016 (1986) (lost profits awarded where the patentee did not manufacture a product equivalent to the infringing product at all during the infringement period). The cases make it clear that the patentee's proof on all issues is that of a reasonable probability. E.g., *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 507 [141 USPQ 681] (1964); *A. Stucki Co. v. Worthington Indust., Inc.*, 849 F.2d 593, 597-98 [7 USPQ 2d 1066] (Fed.Cir.1988); *Yarway Corp.*, 775 F.2d at 275. Polaroid's standard, if that is in fact what it is urging, renders the manufacturing capability requirement meaningless. Any patentee can

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 28

concoct a scenario to achieve the necessary result.

In reality, the legal standard has substance and meaning. Courts have refused to award lost profits when, for example, the use of an alternative facility to meet demand would have required the patent owner to curtail production of another more profitable product. Deere & Co. v. International Harvester Co., 218 U.S.P.Q. 403, 407 (C.D.Ill.1982), *aff'd in part and rev'd in part*, 710 F.2d 1551 [218 USPQ 481] (Fed.Cir.1983). In Deere, the district court found no evidence that the patentee *would* have made the decision to curtail the more profitable product although they *could* have done so. *Id.* at 407. In Water Technologies, the Federal Circuit found no manufacturing capability and refused to award lost profits in part because the patentee had no facilities to manufacture the product commercially. 850 F.2d at 673. Under Polaroid's theory, the patentee in Water Technologies could have met its burden by showing, even under the most improbable scenario, that it *could* have built a production facility. The law is not so easily satisfied.

*41 While it may have been physically possible to match Kodak's volume if Polaroid began to greatly expand its manufacturing capacity from the moment the infringement began, Polaroid has not proven its ability to do so. What is physically possible does, however, serve as a starting point for determining what reasonably could or would have occurred. In this analysis, Polaroid is entitled to every benefit of the doubt. Del Mar Avionics, 836 F.2d at 1327; Lam, 718 F.2d at 1065. Polaroid need only show that it is more likely than not that it would have added the necessary manufacturing capacity. The Court must assume that Polaroid would have labored to meet the demand to the best of its ability.

Of course, the question of Polaroid's ability to expand manufacturing capacity in a timely manner involves not only the company's theoretical technical and physical potential, but also its forecasting and decision-making skills. The task is not to determine what any corporation with Polaroid's assets could have achieved, but rather to find what Polaroid, with its unique corporate personality, would have done in a world without Kodak. In this sense, what Polaroid could and would have done may be the same thing. Mr. Zaffino, Kodak's camera manufacturing expert, put it this way:

In my analysis I have determined what Polaroid realistically and reasonably could have done given all the resources at their disposal and given all the things they did well and things they didn't do so well.

And in my mind, with that understanding, I see no

difference between what Polaroid reasonably and realistically could have done and what they would have done. (Tr 8903). With these principles in mind, I now turn to the facts.

Factual Findings and Conclusions

A. Film Manufacturing

Introduction

Instant film is the key to Polaroid's integral film system. The film is, in and of itself, a fascinating mini-darkroom which must be created with the utmost precision and care. Polaroid designed and built the assembly machines which manufacture its instant film, each machine bigger than my courtroom. These complicated instruments assemble all the principal film components: the positive and negative sheets, the developer pod, and the mask or frame. The machines also cut and seal the individual film units and assemble them in packs of ten with a battery, spring, and cover sheet. The machines are automatic and completely synchronized. They are driven by one shaft which runs along the length of the machine; each turn of the shaft completes one cycle of each sub-assembly station. Packaging is done at the very end, by another connected machine.

Since 1972, Polaroid has produced all the major components for its film: the negative sheet or base, which is the photosensitive material that captures the image; the positive sheet, where the image is formed and upon which the developed picture is viewed; the developer pods, which contain the chemicals that control the developing process; and the batteries, contained in the film pack, which power the camera.

*42 Negative preparation is done on a complex coating machine, called the "x 500," which is five stories high and several hundred feet long. Unlike positive sheet coating, which is done one layer at a time, all the chemical layers of the negative sheet are applied simultaneously to a sixty-inch web of material which runs through the machine at a speed of several hundred feet each minute. Because many of these layers are light-sensitive, the operation must be performed completely in the dark. Polaroid designed and built a special facility in New Bedford which houses the negative coating machine and is itself part of the negative sheet apparatus. The entire process must be completely pure and free of dirt. After coating, the negative material must be aged for six months in a special humidity and temperature controlled environment. Beginning in late 1979, with the advent of Time Zero film, Polaroid prepared part of its negative base in Building W-5 in Waltham on one of the positive coating machines and then transferred this partially-coated negative base to New Bedford for completion.

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 29

The positive sheet is prepared by coating successive layers of chemicals onto a base web sheet. The positive coating and drying machines are hundreds of feet long and several stories high. The web passes through the applicators at several hundred feet a minute. After the first chemical layer is applied to the web, it is dried and re-wound and the process is repeated until all the required layers have been coated on the sheet. During the infringement period, Polaroid housed all its positive coating in Building W-5 in Waltham.

Polaroid also manufactured the card-like batteries which were included in the film pack to power the camera. The batteries were assembled on separate machines and then fed into the film assembly machine for packaging with the film.

In order to manufacture film, Polaroid needed a sufficient supply of each of the components, sufficient assembly machines, and trained employees to operate and maintain the machines. Without any one of these resources, film production would come to a halt. Therefore, my analysis takes into account each of these factors.

Polaroid's ability to manufacture integral film also depends heavily on the effectiveness of its planning process. Polaroid planned its integral film production each year based on a sales forecast. From that forecast, Polaroid prepared a "finished goods" plan and determined the manufacturing requirements for each component. Planning was necessary at successive levels to integrate the numerous operations in the manufacturing process. I have also considered how Polaroid's planning ability affected the company's manufacturing capacity. Of course, to the extent that it is possible, I have tried to ferret out Kodak's influence on that process.

First, I will consider what untapped resources Polaroid had in place during the years of infringement. Next, I will determine whether and when Polaroid could have expanded its manufacturing capacity.

1. Polaroid's In-Place Capacity: Film

*43 Both parties presented an analysis of what incremental production Polaroid could have achieved without investing additional capital. Using the resources Polaroid historically had at its disposal, [FN23] Mr. McNamara for Polaroid and Messrs. Smith and Cook for Kodak, calculated how many additional film packs could be squeezed out of Polaroid's existing operation.

(a) In-Place Capacity of Assembly Machines

Mr. McNamara, whose experience with manufacturing

operations is limited to the accounting work he has done for various clients of Arthur Young & Co., prepared what he called a "fanciful" (TR 3350) schedule in which Polaroid ran its existing operations 353 days a year in every year of the infringement period. Mr. McNamara and his team arrived at these parameters by analyzing Polaroid's historical records and speaking to various Polaroid personnel. Based on the information they gathered, the team estimated how much additional "run-time" was available on the assembly machines and how many packs of film could therefore be produced. Mr. McNamara concluded that even by running 353 days a year in every year, Polaroid could not have satisfied the combined demand for instant film. This analysis was not intended to provide a serious estimate of what Polaroid could achieve, but rather to show that even based on the most optimistic assumptions, Polaroid needed something more in order to meet demand. (TR 3221). However, the basic elements of Mr. McNamara's analysis-- how much a particular machine can be expected to produce, how much time is actually available to produce film, and the availability of components--appear again in both his nine-month and eighteen-month advance scenarios, which are intended as a serious estimate of Polaroid's additional manufacturing capacity. Therefore, I believe it is prudent to examine these assumptions now.

Kodak presented its in-place capacity analysis through Mr. David R. Smith and Mr. Wendell Cook. Mr. Cook analyzed the incremental in-place capacity of Polaroid's negative and positive sheet facilities as well as its battery production capability. Mr. Smith analyzed the in-place capacity of Polaroid's film assembly machines. Together they prepared a chart which sets forth the incremental in-place capacity in all four of these areas. The chart identifies which part of the film manufacturing operation presented the most significant constraint in each year. (DF 61,300B, Tab 2).

At the time of the trial, Mr. Smith headed Kodak's Automatic Machine Systems Design Division, a consulting group within Kodak which designs automatic machinery systems for companies other than Kodak. He was also the Director of Kodak's Converting and Packaging Line of Technology. From 1971 to 1976, he worked on the design and installation of Kodak's instant film assembly machines. Mr. Smith presented a painstakingly detailed and thorough analysis of the additional time available to Polaroid to produce film to meet market demand, and the number of additional film packs Polaroid could produce in that time. Like Mr. McNamara, Mr. Smith concluded that Polaroid could not satisfy 100% of the demand for instant products. Mr. Smith also concluded that Polaroid was capable of producing more film with its existing capacity during the

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 30

infringement period.

*44 Mr. Smith's analysis is sound and reliable. He started with the basics, examining daily shift reports to determine how the assembly machines were being used. Just as Polaroid managers did historically, he divided assembly machine use into "scheduled" and "non-scheduled" time. Of the scheduled time, Mr. Smith determined how much was spent producing "good" product and how much was taken up by unplanned stops and producing unsalable product. He further analyzed the non-scheduled time and determined what portion of that time was available for additional production. Mr. McNamara's analysis differed in one important respect: the portion of non-scheduled time allotted for additional production. This disagreement highlights the reason I find Mr. Smith's analysis so compelling.

There were reasons why Polaroid did not "schedule a machine" other than not needing it for production. Sometimes a machine sat idle because there was no one to run it, such as during a holiday or a storm. Sometimes a machine was idle because it was awaiting maintenance or updating or conversion of parts of the machine. In attempting to expand production, Polaroid could not avoid these particular "downtime" activities. Mr. McNamara and Mr. Smith differed as to whether Polaroid would have been able to eliminate much of the "no coverage time," the time required for machine updating and conversions, and the time production stopped because materials were not available. Especially in the later years, Mr. McNamara and Mr. Smith disagreed about whether Polaroid would have converted some machines to make products besides instant film.

No coverage. Polaroid could not "schedule machines" when it had no one to run them. When employees for whatever reason, did not attend work, Polaroid was unable to staff the machines and those machines would be placed on "no coverage" status. Polaroid experienced a significant amount of no coverage time throughout the infringement period.

No coverage time peaked in 1978. At that time, Polaroid was operating three-shift, five-day schedule but was so pressed to produce film that it was actually running seven days a week on overtime. The company also cancelled the annual vacation shutdown in July. Faced with the prospect of no vacation from this demanding schedule, employee absenteeism increased. A 1978 employee survey showed a high level of employee stress from overwork. (DF 25,371). When Polaroid replaced the overtime work with regularly scheduled shifts, "no coverage time" decreased.

The question is whether Polaroid management, under different circumstances, could have reduced the no coverage time and produced additional film packs. Mr. McNamara assumed that the increased demand would have prompted Polaroid to adopt a seven-day schedule earlier, in January 1978. Mr. Smith "struggled with this one" (TR 10303), but concluded that since Polaroid historically faced more demand than it could handle during those months and yet did not respond, it is unlikely that the combined demand would have made any difference in how Polaroid acted.

*45 On the basis of its historical performance, I find Polaroid could not have reduced coverage time if faced with additional demand. Nothing in the record convinces me that Polaroid could have managed employee absenteeism any better in more demanding circumstances. Polaroid management had to experience extensive no coverage time in 1978 before it corrected the problem. Once Polaroid recognized the need for the off-standard schedule, it took almost nine months to implement it. To begin the new schedule in January 1978, as Mr. McNamara envisions, Polaroid would have had to recognize the need in the spring of 1977. Nothing in the record persuades me that Polaroid reasonably could have taken this step earlier than it actually did.

No material time. Polaroid also took machines out of the production schedule when material was not available, when there were problems with material quality, when the wrong material was supplied, or material did not perform as expected. This "downtime" is distinct from constraints on film production imposed by a lack of material or component capacity. Material time concerns the scheduling and technical problems with the material, not the sheer ability to produce it. For example, each component in instant film must be the proper size. The combination of developer, pod, mask, and rail creates a certain gap between the positive sheet and negative. If the gap is wrong, the chemicals released from the pod may not cover the sheets completely or may leak. So while Polaroid may have had material to supply the machines, it may not have been of the right quality.

Problems of no material capacity became critical at times, especially during the introduction of new products such as Time Zero film. Technical problems coating the L coat on the negative base of the new film caused Polaroid to shut down six assembly machines in 1980.

The summary reports Mr. McNamara used as the basis for his analysis did not account specifically for no material problems before 1982. Mr. McNamara may have factored some no material time into his assessment of "runtime." (PT 3114). Mr. Smith's detailed analysis,

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 31

in contrast, identified significant blocks of time in those years when production ceased for lack of materials. Polaroid could not have eliminated no material time when pressing operations to the limit. No material time is an unavoidable part of the manufacturing process. Indeed, it may be generous to Polaroid not to increase this time given the extra strain that would be placed upon all its operations in attempting to increase production. I find that the exclusion of no material time from non-scheduled time available for additional production reflects a realistic and reasonable judgment about Polaroid's ability to manufacture more film.

Engineering Updates. Polaroid consistently took machines out of production to implement engineering advances that made the machines run more quickly or efficiently. Polaroid engineers were always working on ways to improve machine performance and as they discovered and refined these break-throughs, they installed them on their machines. Partly as a result of these updates, machine speeds increased and yields generally improved during the infringement period.

*46 Mr. McNamara took the time used for engineering updates and added it to the total that could have been used for additional production. Yet Mr. McNamara also used the increased historical machine speeds which resulted, in part, from these updates, Mr. Smith excluded this time but gave Polaroid credit for its historical increases in efficiency and speed. I find that Polaroid could not have avoided these updates and still achieved the company's historical production totals. For example, total yield, a measure of efficiency, grew from sixty-three percent in 1976 to ninety-one percent in 1985, a forty-four percent improvement. If Polaroid had decided not to take its machines out of production for updating in those years, the effect on film production would have been devastating. At the very least, any analysis which eliminates that downtime must adjust the total yield accordingly. No such analysis was offered.

Conversion of machines to produce other products.

Polaroid used its film assembly machines to manufacture products other than consumer instant film. Polaroid also converted some film assembly machines to new processes or new integral products, such as "faceplace," a batteryless film used in photo booths, and "autofilm," a commercial product designed for use with computer terminals. Some machines were also converted to produce Spectra film and integral film with a capless cartridge.

Polaroid's analysis of non-scheduled time assumed that machine downtime for making products other than

integral film would have been deferred or eliminated entirely to make more time available for instant film production. Kodak claims that there is no reason to believe that Polaroid would have passed up the opportunity to develop its non-consumer film business in order to make more integral film. I agree. In fact, at the time autofilm was introduced in 1984, Polaroid was making a concerted effort to expand its commercial and industrial business, which by then generated forty percent of the company's revenues. Polaroid has also not accounted for any profits it earned on the sale of non-integral products. Faceplace was sold throughout the infringement period.

There is particularly strong disagreement about whether Polaroid would have put off the capless conversion of its integral film. This conversion would have molded the end cap, the flap which covered the opening of the film "box," into the film cartridge in order to prevent it from breaking off and ruining the camera. Moreover, end cap production problems were the number one cause of assembly machine downtime. The request for capital funds for the capless conversion also claimed that the molded end cap would improve the way the chemicals were distributed across the film when the pod was burst. The net associated cost savings from capless conversion was projected to be in the order of \$900,000 per 100 million units.

Polaroid commenced the capless conversion process by a 1-A work order, a type of order reserved for emergency projects that allowed work to begin on a capital project without Board approval. When the project began in November 1978, film production was operating seven days a week and was still unable to keep up with demand for film. Polaroid was also building SX-70 cameras as fast as it could at this time. The capless conversion was eventually abandoned because the machines were a disappointment and did not perform as well as before the conversion.

*47 Mr. George Fernald, the Polaroid fact witness who testified about machine operating parameters, stated that Polaroid would have shelved the capless conversion in the face of higher demand. Mr. Fernald's opinion, however, ignores the fact that Polaroid, at the time the conversion was attempted, already faced more demand than it could handle and, because of limited film production capacity, was considering limiting camera production. On cross-examination, Mr. Fernald did not recall what the demands were on the film division at that time. (TR 2812-17). Mr. McNamara incorporated Mr. Fernald's opinion in his analysis.

I believe Polaroid could not reasonably have avoided the

Not Reported in F.Supp.

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

Page 32

capless conversion. While the change was not ultimately profitable, manufacturing problems were a leading cause of machine downtime and, when the cap did break off, it destroyed the consumer's camera. Perhaps, with hindsight, the conversion seems like the type of activity that could be eliminated in favor of more machine production hours but I do not believe Polaroid should be credited with 20/20 hindsight that shows today that the attempted conversion was futile. The capless conversion time could not have been used for additional production. Mr. Smith's analysis of the new products/conversion time is sound and I adopt it.

For these reasons, I find that Mr. Smith's opinion of the incremental capacity of Polaroid's in-place assembly machines is reasonable and credible and I adopt it as fact. In each year, Polaroid would have been able to produce some additional film without expanding its facilities consistent with Mr. Smith's findings as reported in Tab 2 of DF 61,300B. Polaroid, however, would not have been able to make 100% of Kodak's sales.

(b) In-Place Capacity of Components

Mr. Cook performed Kodak's analysis of the incremental in-place capacity of Polaroid's negative and positive sheet coating and battery operations. At the time of his retirement in 1986, Mr. Cook was a Vice-President of Eastman Kodak and the general manager of Kodak Park Division, the division of Kodak which manufactures all Kodak photographic film, paper, and chemicals. Mr. Cook was the assistant general manager of that division during the infringement period. In his early days at Kodak, Mr. Cook held positions of increasing responsibility in the Roll Coating Division which manufactured photographic film base.

Mr. Cook concluded that while Polaroid could have increased its output of film and battery components in each year, it could not have produced enough to satisfy all the demand in any year except 1976. [FN24] According to Mr. Cook, positive sheet capacity was the most significant constraint on Polaroid's ability to produce more film in 1979. In 1980, negative base coating, the new initial coating that was performed in W-5 on the No. 9 coater, was the most significant constraint. Mr. Cook also stated that Polaroid's ability to produce the higher-powered batteries for the Sun system was the most significant constraint on Polaroid's ability to produce more film packs in 1981.

*48 Mr. McNamara concluded that Polaroid had the ability to supply all the components it would have needed under each scenario he presented. However, a detailed analysis of his scenarios is missing; Mr. McNamara

simply provided an unimpressive list of costs that would be incurred in the battery and positive sheet operations if Polaroid produced all the additional film. The costs result from additional shifts. The list includes one expense in 1976 for sheet and identical costs each year for seven years for batteries. (PT 2367A, Tab 17). Presumably, Mr. McNamara has made some principled estimate of what the existing resources were capable of producing and what additions he felt were required in the component operations, but he did not present the details of that estimate to the Court. I find it very difficult to judge the reasonableness or accuracy of his conclusions about this essential part of film production capability without knowing the foundation upon which they are based.

Positive Sheet. Mr. Cook's analysis of positive sheet coating follows the same steps as Mr. Smith's analysis of film assembly. He identified scheduled and non-scheduled time and determined the amount, in equivalent film packs, that Polaroid could squeeze out of the operation by running at full tilt but without building a new coater. His conclusions about downtime are similar to Mr. Smith's. For example, Mr. Cook concluded that Polaroid would not have instituted a seven-day production schedule earlier than it did historically. Mr. Cook used the historical coating speeds and rejected the notion that Polaroid could have increased coating speed earlier in time if faced with additional demand. He also added the capacity of the 10A tandem coater in February 1979 when it was installed historically, despite Polaroid's urging that it could have been installed earlier. [FN25]

In 1979, positive sheet coating capacity would have been the limiting constraint on Polaroid's ability to manufacture more integral film. Over the course of the entire year, only 183 reserve hours were available on both the No. 9 and No. 10/10A coaters combined. In 1978, positive sheet coating was also significantly limited. During 1978, W-5 operated virtually twenty-four hours a day, with just thirty-two hours of reserve time available that entire year. Overall, I find Mr. Cook's analysis of Polaroid's positive sheet coating apparatus to be thorough and credible. It is based on sound assumptions and conclusions which were unshaken on cross-examination.

Negative Base. When Polaroid began producing Time Zero film it had to coat part of the negative base in W-5 on the No. 9 coater. It began this operation in the second half of 1980. According to Mr. Cook, Polaroid's ability to coat negative base would have been the limiting constraint on its capacity to produce more film in that year. Because the negative sheet required six months aging between coating and assembly, only negative base manufactured during the first half of a given calendar year

Not Reported in F.Supp.

Page 33

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

and the last half of the prior year will support the manufacture of finished film packs during that year. When Mr. Cook looked at what additional time he could extract from 1980, he had to examine negative coating in 1979. Since the product had not yet been developed, no negative base was available from the second half of 1979. Therefore, the only additional film production time available in 1980 would be in the second quarter of 1980.

*49 I find Kodak's assessment of negative base coating in W-5 right on track. Because I have found that Polaroid would have introduced Time Zero film when it did, incorporating the problems associated with the Time Zero changeover is accurate and appropriate.

New Bedford Negative Coating. Mr. Cook's New Bedford analysis is similar to the analysis for positive sheet; he identified those times in which Polaroid could have produced more negative sheet taking into account historical interruptions such as vacations, maintenance, running other products, and the required aging. I find Mr. Cook's conclusions about the x 500's speed, length of coating runs, and total yield appropriate and reasonable despite Polaroid's arguments that it could have increased production earlier in time. I fully adopt his findings in this area.

Batteries. In 1981, Polaroid began the transition to using a new kind of battery, the P-80, to power the new Sun cameras which required more energy. However, because the P-80 was not ready in time for the Sun introduction, Polaroid modified its old battery, the P-70, by adding more active ingredients. Unfortunately, a contamination problem, discovered earlier, was much more pronounced in this modified battery. Consequently, Polaroid workers spent a great deal of time sorting out the bad batteries and Polaroid shipped some batteries that lacked the proper aging. Because of these problems, the reserve time and yields were very low in Mr. Cook's analysis.

Nothing in the record suggests that Polaroid could have avoided the battery problem in a Kodak-free marketplace. Indeed, Polaroid has claimed that it would have introduced the Sun system even earlier so it is possible that these development problems would have been even more pronounced. Therefore, I believe Mr. Cook's analysis in this regard is credible and sound.

Conclusion

I find that Kodak's analysis of Polaroid's ability to produce additional film packs from existing resources is reliable and compelling. It is based on thorough research, well supported by Polaroid documents and the statements of Polaroid insiders. By meticulously identifying the basis for their judgments about how

Polaroid could reasonably have increased production, Kodak's experts have given the court confidence that their analysis is sound and fair.

2. Polaroid's Potential Film Manufacturing Capability

Polaroid presented two scenarios to show how it "would" have increased manufacturing capacity to meet the combined demand for film in a "but for" Kodak world. One accelerates the company's historical capacity decisions nine months and the other advances the decisions eighteen months. I cannot adopt the results derived from either scenario because the analysis includes the same unrealistic estimates of runtime parameters that comprised Polaroid's in-place capacity illustration. [FN26] Therefore, were I to adopt Polaroid's assertions that additional resources could have been brought on line earlier, I would be left on my own to calculate how many additional film packs could have been produced under more reasonable operating parameters. Given the complexity of these calculations and the fact that I was often presented with only the results and not the raw materials for the calculations, it is nearly impossible to accomplish this task with any precision.

*50 Kodak presented an analysis of Polaroid's potential capability consistent with its theory of demand. Kodak experts crafted scenarios and performed calculations showing: (1) a progression of five, fifteen, and sixty percent of Kodak's sales; (2) twenty-five percent of Kodak's sales; and (3) fifty percent of Kodak's sales. Mr. Gene Brown developed hypothetical forecasts for Mr. Cook that simulated Polaroid forecasts given these three levels of demand. Following Polaroid's practice of planning production for twenty percent over forecast, Mr. Cook predicted what capital decisions Polaroid would have made. Having decided the start dates, Mr. Cook calculated the length of time required to bring on line new component manufacturing capacity. Mr. Smith calculated the same for assembly machines. The resulting additional film packs appear at Tabs 3, 4, and 5 of Mr. Cook's report. (DF 61,000A; DF 61,000B).

Unfortunately, those calculations are also not helpful to me because I have rejected Mr. Brown's demand estimates. At my urging, Mr. Cook and Mr. Smith were asked their opinions about how much additional production Polaroid could achieve if faced with 100% of the demand. It is their answer to this question which I compare next against Polaroid's claims about the speed with which it could have brought additional manufacturing capability on line.

Mr. Smith believed that even if Polaroid tried to meet 100% of combined demand, it could not have increased

Not Reported in F.Supp.

Page 34

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

the number of assembly machines at all between 1976 and 1978. [FN27] From 1979 to 1981, Mr. Smith opined that Polaroid probably could have produced slightly more film packs than under the fifty percent demand scenario. From 1982 on, he believes Polaroid could have met all of the combined demand.

Mr. Cook claims that because of the long lead times required to operate the coating machines, even if faced with 100% of demand, Polaroid would not have been able to increase manufacturing capacity for positive sheet until mid-1979, and would not be able to increase negative coating capacity until mid-1980. He did not comment specifically on battery capacity under these circumstances. Moreover, Mr. Cook pointed out that if Polaroid did build new negative and positive sheet coating machines, the costs of those machines must be included in the lost profits calculation.

(a) *Film Assembly Machines*

1977-1978. Mr. Smith concluded that even if Polaroid faced all of the combined demand, the company would have been unable to bring film assembly machines on line any faster in 1977 and 1978 than it did in the real world. His analysis of all demand levels shows that with reasonable consideration of the time required to order parts and build the machines, and considering the availability of qualified people to operate the machines, Polaroid achieved the most that could be expected. The schedule could not be accelerated.

If Polaroid had started constructing some machines earlier than it did historically, it might have increased production in those years even using Mr. Smith's building rates. However, I find that it is not probable that Polaroid would have (and therefore not likely that it could have) started a sufficient number of machines to make a difference during these early years, 1977 and 1978.

***51** *The time required to bring machines into production.* The key to Mr. Smith's conclusion that no additional assembly machines could be brought on line in 1977 and 1978 is his analysis of the time required to bring the machines into production. [FN28] Mr. Smith's timelines differed considerably from those presented by Polaroid.

Mr. Lawrence, who at critical times in the infringement period served as program manager at Polaroid's equipment facilities division, devised an illustrative construction schedule from starting dates provided by Mr. McNamara. When the infringement began, twelve film assembly machines (Nos. 13-24) were in various stages of completion. Except for machine No. 17, Mr. Lawrence shortened the time it actually took to bring each machine into production. For example, it took ten months to bring

machine No. 13, which was partially completed when the infringement began, into production from its authorization date in April 1976. In Mr. Lawrence's illustrative schedule, the machine could begin producing film in only three months. The schedule considerably shortened the time required for the initial paperwork, to order and receive parts, and to assemble crews. (See TR 2955-57; 2961-66; 2970-74).

Mr. Lawrence believed that Polaroid could have accelerated its schedule although the bulk of evidence shows that Polaroid was building as fast as it could and was still unable to meet demand. In the spring of 1977, the film division was operating at maximum capacity and Polaroid management requested that the engineering division bring machines into production as quickly as possible. (PT 2328). Although Mr. Lawrence's shop worked very quickly and efficiently and they were able to bring some machines on line earlier than they had planned, they could not have worked any faster. For these reasons, I think Mr. Lawrence's schedule is improbable.

Mr. Smith concluded that Polaroid could not have completed any of the twelve partially-completed machines in R-2 any earlier than they were completed historically. With extensive documentation, Mr. Smith showed the difficulty that Polaroid faced in obtaining parts for the machines, some of which had been borrowed from other, idle machines. Time-consuming drawings were needed in order to fabricate some of the required parts. Moreover, despite repeated requests from the film division to get these machines into production sooner, Polaroid was unable to accelerate their installation. (TR 10214; DF 61,342 at 119-21). For these reasons, I agree with Mr. Smith. Polaroid could not have brought those machines into production more quickly than it actually did.

Although Polaroid never completed a machine in less than twenty months, Mr. Lawrence estimated that some new machines could be constructed in as little as twelve months while others might take up to seventeen months. Giving Polaroid the benefit of the doubt on some evidence, Mr. Smith estimated that new machines would take an average of eighteen months to build. The difference in their conclusions is directly related to differences in their assumptions. Mr. Lawrence assumed that Polaroid would not encounter any resource constraints and that skilled engineers and parts would be available precisely when needed. Mr. Smith closely examined the lead times for parts and took into account the difficulty Polaroid experienced in obtaining skilled personnel. Kodak's analysis is realistic and more accurately represents what Polaroid could have achieved.

Not Reported in F.Supp.

Page 35

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

**52 Machine starting dates.* Having found that Kodak's timelines best represent how quickly Polaroid could bring the machines into production, I now examine Polaroid's claim that it would have authorized machines at an earlier point in time. [FN29]

The "could v. would" problem re-visited. Before I compare the parties' assumptions regarding when machines could have been started, it is important to point out the ambiguity in Polaroid's approach which makes it difficult to judge whether its dates are feasible. I have doubts about whether Polaroid is really trying to describe the relationship between demand and decisionmaking when it posits the dates on which it would have started the machines. Polaroid's analysis appears to be backwards. Statements in the record lead me to believe that Polaroid simply tried to determine the dates upon which it must have necessarily begun in order to meet the demand, without taking into account the feasibility of that expansion. The two relevant Polaroid witnesses who testified on this point were Mr. McNamara and Mr. Booth.

Mr. McNamara gave his expert opinion about how far to advance Polaroid's capital decisions in the calculations presented. Upon hearing his direct examination, I believed that he had completed a scaled-down version of Kodak's analysis, looking at the historical relationship between demand and capital decisions and, by changing the demand, predicted the corresponding capital decisions. Mr. McNamara gave this explanation:

A. What I'm reporting here is that in looking at the historical record of Polaroid and its response to increases in demand that it was experiencing in connection with its integral film, I compared that to an analysis of the combined--of the increases in the combined volume of Polaroid and Kodak film and made an analysis which showed me that in the real world when the volumes of Polaroid film reached a certain level, they started to undertake a rapid expansion program to bring more machines on line.

In comparing that to the same level of the combined Polaroid/Kodak increases in demand for film, this is actual production, I notice that that time period was approximately nine months earlier.

I then concluded, let me try to make a calculation which would assume that Polaroid, recognizing the increase in demand represented by the combined volume, would have responded as it did in the real world at that point in time with a schedule making machines available nine months earlier. So that the authorization dates would be moved

up nine months.

(TR 3223-24). But upon cross examination, Mr. McNamara seemed to retreat from saying he determined how Polaroid would have responded to the combined demand. At TR 3346-47, he began with the same explanation given earlier, and even stated that he had graphed the historical relationship between demand and capital decisions and then plotted the combined demand on the same graph to show that Polaroid would have reached the same capital decisions nine months earlier. [FN30] Then, he seemed to retreat:

**53 Q.* So you yourself, formed no opinion as to whether Polaroid's management would have made these decisions nine months earlier or 18 months earlier than they actually did?

A. What I did was to look--that fact that at a point in time Polaroid management made a decision, a series of decisions, those decisions were to expand capacity on a rapid basis. I looked at that as I just described, and moved that decision point back nine months. I also moved it back 18 months.

Q. Right. Just so we're clear. You're not offering an opinion as to whether Polaroid's management would have made those decisions nine months earlier or 18 months earlier than they actually did?

A. What I am saying is that could have, based on the historical record as to what actually happened when it happened.

Q. So as to this aspect of your study, you're talking about what they could have done, not in fact what they would have done?

A. That's their decision point.

(TR 3352-53). It is unclear to me whether Mr. McNamara simply counted backwards from the production requirements he wished to meet or whether he offered a principled scenario about how Polaroid could have expanded to meet the demand. The most favorable reading I can give his testimony is that he believes that, consistent with the way Polaroid responded to demand in the past, Polaroid reasonably could have added resources any where from nine months to eighteen months earlier if faced with the combined demand. Unfortunately, Mr. McNamara has given the Court very little support for that conclusion.

Mr. McNamara's eighteen-month advance scenario had its genesis in the trial testimony of Mr. Booth regarding

Not Reported in F.Supp.

Page 36

1990 WL 324105 (D.Mass.), 16 U.S.P.Q.2d 1481

(Cite as: 1990 WL 324105 (D.Mass.))

the One-Step camera. Mr. Booth testified that if Polaroid had planned the introduction of the OneStep in a Kodak-free market, it would have predicted the surge in demand for film, and it would have begun gearing up the film operation eighteen to twenty months earlier. Although I have found that Polaroid would have introduced the OneStep when it historically did, it is possible that Polaroid would have planned better without Kodak and Mr. Booth's testimony in that regard is illuminating. If this had been his only testimony, my task would be simple enough: to judge whether Mr. Booth's opinion about Polaroid's abilities to forecast and plan are credible and consistent with the rest of the record. However, Mr. Booth went on to testify about Polaroid's response to the combined demand for the whole infringement period, of which the OneStep is only one part. Here, he did not give the Court an opinion about when he would have begun to increase production. Instead, he seemed to say, looking backwards, how much time he would have needed to meet the combined demand:

Q. Mr. Booth, if you were called upon to ask the--to ask the manufacture [sic] to combine volume of the Polaroid and Kodak's instant film and cameras during that time period, can you tell the court what you would have needed in lead time in order to do that?

*54 A. I think in the same 18-month period that I'm just talking about, 18 months to 20 months.

(TR 2301-302 (emphasis added)). Again, I am unsure about whether Mr. Booth is testifying that Polaroid would have advanced all capital decisions eighteen months or whether he believes eighteen months advancement is what the calculations require. Mr. McNamara used this testimony as the basis for advancing all capacity decisions by eighteen months.

In any case, Polaroid must prove, by a preponderance of the evidence, that it had the potential capability to meet the demand. Bio-Rad Laboratories, 739 F.2d at 616. The vague and unconvincing evidence tending to show the likelihood that Polaroid would have made these decisions earlier handicaps its proof on this issue.

Under the nine-month scenario, Polaroid claims it would have authorized machines number 13-24 all in April 1976. Except for Mr. McNamara's study, there is no direct support for this assertion. On the contrary, a great deal of evidence shows that the scenario is unlikely. My analysis of the nine-month scenario applies *a fortiori* to the eighteen-month scenario which calls for twenty-four machines to be authorized in January 1976, before the infringement even began.

Polaroid added film assembly machines on the basis of requests from the film division which, in turn, based its requests upon film sales forecasts derived from forecasts of camera sales. I do not believe Polaroid is legally entitled to credit for perfect foresight in this hindsight analysis of potential capability. Therefore, I must consider Polaroid's forecasting and planning capabilities as part of its manufacturing capability. In order to find that Polaroid could have authorized all twelve machines in April 1976, I have to find that it reasonably could have predicted the demand that was to follow.

In general, Polaroid's ability to forecast sales was poor. Mr. Booth claims that Polaroid would have predicted the demand for film that would have been generated by the OneStep, but this is contrary to Polaroid's experience with the introduction of other models. [FN31] Polaroid's sales forecasts were inaccurate even before the infringement began. Forecasts were off on the SX-70 and, even in the pack era, Polaroid had trouble meeting the demand for its popular Swinger and Colorpack II cameras. Polaroid's inability to forecast was unrelated to Kodak's entry; Polaroid failed to accurately forecast sales before, during, and after the infringement period. (TR 8633-34 and related charts).

Although I believe Polaroid's ability to forecast was somewhat impaired by Kodak's entry, I am not convinced that it could have done better in the world without Kodak. The phenomenal success of instant photography in the late 1970s, based in part on the immense success of the OneStep and the Handle, surprised both companies. Film assembly machines are complex tools which take considerable time to design and build. Polaroid needed much more sophisticated forecasting and planning skills in order to have expanded manufacturing capacity in so short a period of time.

*55 Based on Mr. Cook's and Mr. Smith's analysis of how quickly Polaroid could have responded to the combined demand, including when Polaroid would have authorized the start up of additional machines and how long it would have taken before they were in production, I find that Polaroid could have not have expanded its film assembly capacity in the years 1977-1978.

1979-1980. According to Mr. Cook's in-place capacity analysis, the most significant constraint on Polaroid's ability to produce more film in 1979 was its ability to supply positive sheet. Except for Mr. McNamara's summary treatment of the costs of supplying some components, Polaroid presented no evidence of its ability to expand its component manufacturing facilities.

In order to meet the combined demand for film in 1979,